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**SPECIAL ADVANCED STUDIES FOR
POLLUTION PREVENTION**

**Delivery Order 0065: "The Monitor" –
Summer 2000**



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STINFO FINAL REPORT

**MATERIALS AND MANUFACTURING DIRECTORATE
AIR FORCE RESEARCH LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433-7750**

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THIS TECHNICAL REPORT IS APPROVED FOR PUBLICATION.

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AIR FORCE SERVES AS THE LEAD AGENCY FOR A JOINT GROUP ON POLLUTION PREVENTION INITIATIVE TO "GREEN" SUPPORT EQUIPMENT... SEE [PAGE 3](#)



JOINT EFFORT REUSES TUCSON EQUIPMENT... SEE [PAGE 22](#)

In this issue...

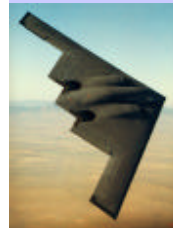
AIR FORCE SERVES AS THE LEAD AGENCY FOR A JOINT GROUP ON POLLUTION PREVENTION INITIATIVE TO “GREEN” SUPPORT EQUIPMENT	3
OVERVIEW OF THE CLEAN AIR ACT (CAA)	9
DEPARTMENT OF DEFENSE (DOD) CLEAN AIR ACT (CAA) SERVICES STEERING COMMITTEE (SSC)	10
OVERVIEW OF THE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)	11
OVERVIEW OF THE CHROMIUM ELECTROPLATING NESHAP	16
HEXAVALENT CHROMIUM AIR EMISSIONS CONTROL FROM PLATING BATHS.....	18
HILL AFB UPGRADES EMISSION CONTROL EQUIPMENT TO MEET CHROMIUM STANDARDS.....	19
NON-CHROMATE CONVERSION COATING	20
AIR PERMIT COMPLIANCE THROUGH POLLUTION PREVENTION AT AIR FORCE PLANT 44, TUCSON, AZ.....	20
JOINT EFFORT REUSES TUCSON EQUIPMENT	22

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AIR FORCE SERVES AS THE LEAD AGENCY FOR A JOINT GROUP ON POLLUTION PREVENTION INITIATIVE TO "GREEN" SUPPORT EQUIPMENT

Within the Air Force, support equipment (SE), such as hydraulic service units and maintenance stands (see Figure 1), is painted on a three to five year cycle for corrosion prevention, camouflage, and appearance. Sometimes this cycle is further shortened or lengthened depending on the local environmental conditions and operating requirements. The existing SE coating process uses solvent-borne and chromate-based primers and topcoats that are subjected to environmental, safety, and health (ESH) regulations. Compliance with these ESH requirements has increased operating costs and in some cases impacted SE availability. Additionally, the frequent painting cycle has led to excessive layers of paint on SE that can cause premature failure of the coating system or premature structural failure due to hidden cracks and corrosion.

The Joint Group on Pollution Prevention (JG-PP) is currently executing a joint service project to identify an alternate environmentally compliant SE coating with a longer service life. Preliminary cost-benefit analyses indicate that this project can significantly decrease both the environmental burden and operating costs associated with coating SE in depot and field level activities. This project has received stakeholder buy-in from the Army, Navy, Air Force, and National Aeronautics and Space Administration (NASA). The Air Force serves as the lead agency for this project, which began in 1999. This article provides an overview of the JG-PP and summarizes the group's current and future efforts under the Low/No Volatile Organic (VOC) and Nonchromate Coating System for SE project.

Powered Support Equipment	
➤	Avionics
➤	Portable/Mobile Generators
➤	Air Compressors
➤	Hydraulic Service Units
➤	Air Conditioners
➤	Ground Heaters
➤	Light Carts
➤	Gas Turbine Service Equipment
➤	Universal Maintenance Stands
➤	Self-Propelled Bomblifts
Non-Powered Support Equipment	
➤	Maintenance Stands
➤	Towbars
➤	Oxygen/Nitrogen Service Carts
➤	Jacks

Figure 1. Examples of Support Equipment (SE)

Background

Figure 2 provides a listing of the current Joint Logistics Commanders (JLC), the JG-PP Principals, and the JG-PP Working Group Members.

Joint Logistics Commanders	JG-PP Principals	JG-PP Working Group Members
General John G. Coburn Commander Army Materiel Command	MG David R. Gust Deputy Chief of Staff for Research, Development and Acquisition HQ Army Materiel Command	Mr. George Terrell AAPPSSO HQ Army Materiel Command
Vice Admiral James F. Amerault Deputy Chief of Naval Operations (Logistics)	Rear Admiral Larry C. Baucom Director of Environmental Protection, Safety and Occupational Health Chief of Naval Operations (N45)	Mr. Winston DeMonsabert Pollution Prevention Branch Chief of Naval Operations (N45)
General Lester L. Lyles Commander Air Force Materiel Command	Brigadier General Stanley A. Sieg Director of Logistics HQ Air Force Materiel Command	Ms. Debora Meredith Chief, Logistics Environmental Office HQ, Air Force Materiel Command
General Gary S. McKissock Commander Marine Corps Materiel Command	Mr. R. Ken Trammell Executive Director Marine Corps Materiel Command	Mr. John Wolfe Marine Corps Logistics Bases
Lt. General Henry T. Glisson Director Defense Logistics Agency	Major Gen. Timothy P. Malishenko Commander Defense Contract Management Agency	Mr. David James Defense Contract Management Agency
	Ms. Olga Dominguez Director, Environmental Management National Aeronautics and Space Administration	Mr. Robert Hill Kennedy Space Center National Aeronautics and Space Administration

Figure 2. Listing of JLC, JG-PP Principals, and JG-PP Working Group Members

The JG-PP is composed of Flag Officers or equivalent from the Army, Navy, Air Force, Marine Corps, Defense Contract Management Agency (DCMA), and NASA. The JG-PP was chartered in 1994 by the JLC “to develop a process for jointly demonstrating, validating, and implementing environmental technologies to mitigate cost and risk.” In 1998, the group was re-chartered to also address sustainment related concerns and to add NASA as a principal member. Currently, the JG-PP Working Group members are executing 11 new depot related projects and four projects with NASA as a partner. Details related to on-going JG-PP activities are available on the JG-PP web page at: <http://www.jgpp.com>.

The JG-PP Working Group (see Figure 2) has designated Headquarters Air Force Materiel Command, Logistics Environmental Branch (HQ AFMC/LGP-EV) as their lead member and Program Manager the Low/No VOC and Nonchromate Coating System for SE Project. All the services (i.e., AF, Army, Navy, and Marine Corps), the Air Force Corrosion Prevention and Control Office, Air Force Support Equipment and Vehicle Maintenance Directorate, and NASA have technical representatives as working board members. The Army and Marine Corps have unique requirements for SE related to chemical agent resistant coatings (CARCs) and are primarily monitoring this effort.

An overview of the existing SE baseline coating system, a project description, project results to date, and future efforts under the Low/No VOC and Nonchromate Coating System for SE project are provided below.

Overview of the Existing SE Baseline Coating Process

The current SE coating process involves the wet-spray application of primers and topcoats by high volume low pressure (HVLP), airless, and electrostatic methods. These coatings are typically applied to aluminum, steel, and composite substrates on the exterior and interior of powered and non-powered SE.

As shown in Figure 3, the typical organic coating process involves surface preparation, priming, topcoating, and marking operations. SE parts first undergo surface preparation, such as cleaning, scuff sanding, or abrasive blasting and masking

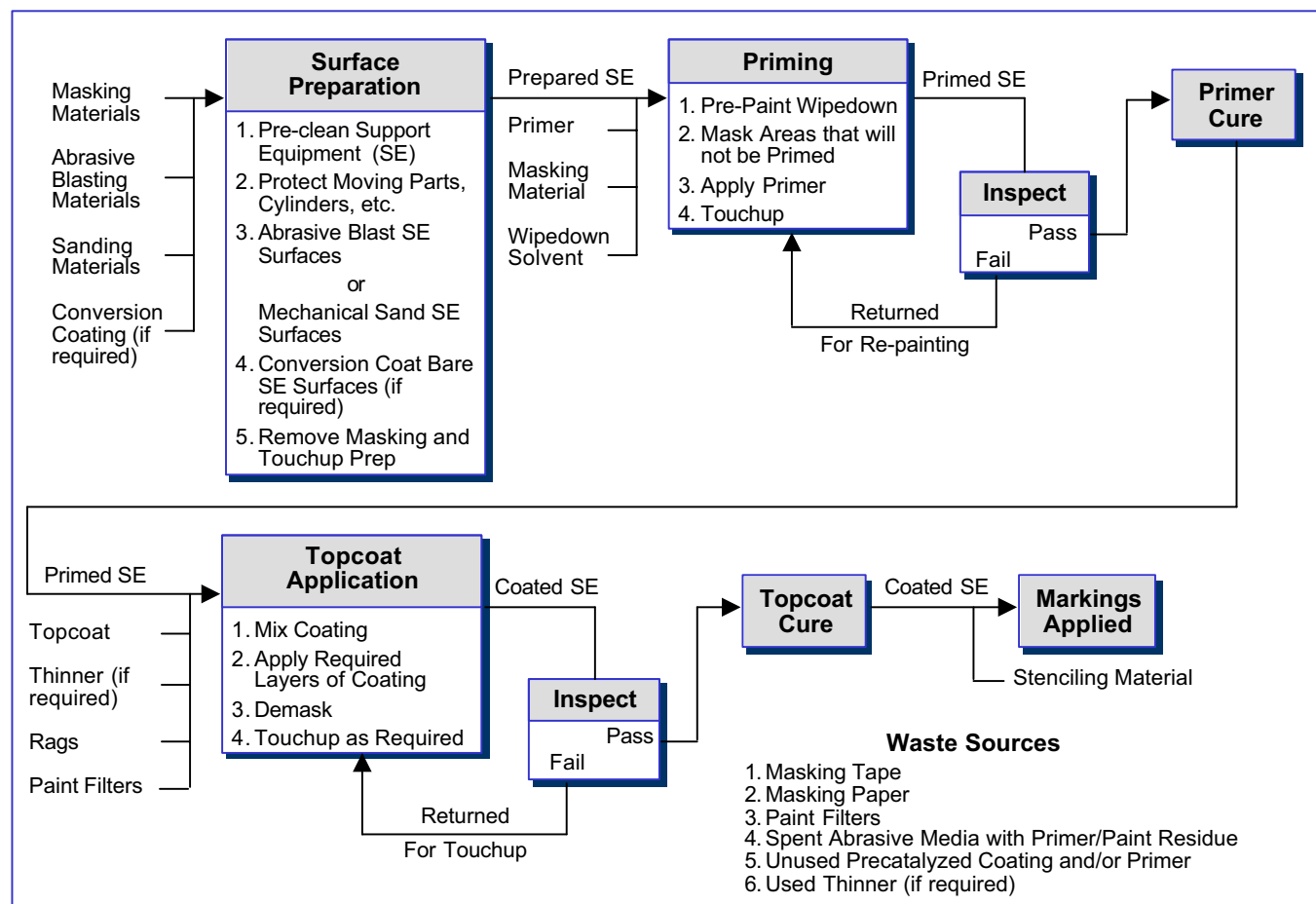


Figure 3. Overview of Typical SE Coating Process

to protect areas on substrates that are not to be coated. The parts requiring additional adhesion enhancement or corrosion protection receive one or two coats of primer and are air cured. Next, the primed parts are topcoated, with air curing between each coat. Markings such as equipment identification, caution and warning information, and operational instructions are applied using materials such as aerosol spray, metal data plates, and vinyl decals.

Several of the current primers and topcoats used on SE contain organic hazardous air pollutants (HAPs) such as methyl ethyl ketone (MEK), toluene, and xylene (see Figure 4). Several primers also contain chromates that are carcinogens. As a result, the air emissions and liquid and solid wastes generated from using these primers and topcoats are considered to be hazardous and subjected to environmental regulations. In addition to the increased operating costs imposed by these regulations, chromated primers and solventborne primers and topcoats may be associated with potential health issues. In several locations, certain primers can no longer be procured or used. The driving forces, which directly impact operating costs, SE availability, service life, and possibly production schedules, have required the Department of Defense (DoD) and NASA to identify, evaluate, and implement acceptable alternatives to existing coatings used on SE.

Target HazMats	Current Process	Applied To	Current Coating Specifications	Affected Agencies	Substrates
Hexavalent Chromium Lead Organic HAPs (e.g., methyl ethyl ketone [MEK], toluene, and xylene)	Wet-spray application of primers and topcoats by high volume low pressure (HVLP), airless, and electrostatic methods	Exterior and interior of powered and non-powered SE	MIL-PRF-23377 MIL-PRF-26915 MIL-PRF-53030 MIL-PRF-85582 MIL-PRF-85285 MIL-PRF-53022 MIL-PRF-22750 MIL-C-46168D MIL-C-53039A MIL-PRF-64159 CATH-COAT 304 inorganic zinc-rich primer, DEVRAN 201 epoxy primer, DEVTHANE 369 aliphatic urethane	Air Force, Army, Marine Corps, Navy NASA	Aluminum, steel, and composites

Figure 4. Target HAZMAT/Coatings for the JG-PP SE Project

Project Description

The purpose of the Low/No VOC and Nonchromate Coating System for SE project is to test, evaluate, and validate alternative primer/topcoat systems for use on DoD and NASA SE. The intent of this project is to validate and transition existing environmentally compliant, high service coating systems on SE, while reducing hazardous waste, VOC, and HAPs.

The products of this project effort will include a Potential Alternatives Report (PAR), a Joint Test Protocol (JTP), a Joint Test Report (JTR), and Cost Benefit Analyses (CBAs). The PAR identifies alternatives considered and documents selection of alternatives to be tested. The JTP documents the performance requirements for alternate coatings. The JTR will document the data and results of the testing on the potential alternative technologies. The CBAs will support implementation of a viable coating by identifying the reduction in total ownership cost (TOC).

Project Results

In November 1999, the government stakeholders listed in Figure 5 (see page 6) endorsed the JTP, indicating that their organization's SE coating performance requirements are represented in the JTP. The JTP standardizes the testing and qualification requirements for future SE coating systems. The recommended tests in the JTP were derived from engineering, performance, and operational impact (supportability) requirements defined by the key stakeholders. A copy of the JTP is available on the JG-PP website (www.jgpp.com).

Government Agency	Joint Test Protocol (JTP) Approval Authorities
Air Force	Mike Schleider, Support Equipment and Vehicle Management Directorate (WR-ALC/LE)
Army Research Laboratory (ARL)	John Escarsega, Coatings Technology Team
Navy	Gabrielle Korosec, NAWCAD, Lakehurst
NASA	Louis MacDowell, Material Science Division

Figure 5. JTP Approval Authorities for SE Project

the alternatives listed in Figure 6 on DoD and NASA sustainment activities and will identify the potential cost avoidance associated with implementation of the selected alternatives.

Technology	Primer/Topcoat System Selected for Screening	
	Primer	Topcoat
Film Technology	Primer (MIL-P-53022)	3M Fluoropolymer Paint Replacement Product (Applique)
	Primer (MIL-P-53022)	Fluorogrip, Grade E
Metal Wire Arc Spray (MWAS)	Platt Bros. 100% Zinc Rich Coating	Defthane Zero VOC Topcoat
	Platt Bros. Zn/Alum 85/15 Metallizing Wire	Defthane Zero VOC Topcoat
High Solids Coating	(no primer)	Ameron PSX 700 Siloxane Self Priming Topcoat
	Dimetcote 9HS Zinc Rich Primer	Ameron PSX 700 Siloxane Self Priming Topcoat
	Devco 304H	Ameron PSX 700 Siloxane Self Priming Topcoat
Powder Coating	Morton 13-7004 Corvel Zinc Rich Primer	Morton 30-1007 Corvel Clean White U 1578-1
	DuPont ELH503S5 Gray Morning	DuPont PFW510S9 Sky White
Waterborne Coatings	Deft 44-W-7 Intermediate Primer (on QPL of MIL-P-53030)	Defthane Zero VOC Topcoat
	Deft 44-GY-16 Zinc Rich Primer (MIL-P-26915)	
	Aqua-Poxy 912	Defthane Zero VOC Topcoat

Figure 6. Coating Systems Downselected for Further Testing

Future Efforts

Based on the test and qualification requirements outlined in the JTP, rigorous laboratory and field testing will now be conducted on the 11 identified coatings/coating systems. All laboratory testing will be compared against the control coatings listed in Figure 7.

The selected coatings (see Figure 6) will be further down-selected for each technology grouping based on the results of the following laboratory testing:

- **Screening tests** – will be conducted on all coatings to ensure that these candidates meet minimum performance requirements.
- **Common tests** – will be performed on alternatives that meet the screening tests' acceptance criteria. These tests are required by all stakeholders.
- **Extended tests** – represent service/agency specific tests that are required by one or more, but not all, of the stakeholders. These tests may be unique to that particular service/agency mission profile rather than the entire DoD and NASA.

Service/Agency	Primer	Topcoat
Army	MIL-P-53022B	MIL-C-46168D or MIL-C-53039A
NASA	Devco Inorganic base primer, Zinc CATH-COAT 304 Devco intermediate epoxy primer, DEVTRAN 201	Devco Aliphatic Urethane, DEVTHANE 369
Navy	MIL-P-53022B, Type II	MIL-PRF-85285C Type II
USMC USAF	MIL-P-53022B, Type II ^a	MIL-PRF-85285C Type II

a. WR-ALC/LE, agreed that the Air Force will accept the test results obtained using MIL-P-53022B Type II and MIL-PRF-85285C Type II as the "worst case scenario" as compared to (MIL-P-23377, Class C and MIL-PRF-85285C)

Figure 7. Standard/Control Coating System for Test Evaluation

Ease of application, surface appearance, pot life (viscosity), dry-to-touch (sanding), and cure time (MEK solvent rub) are the screening tests that will be conducted on the alternative coating systems. The JTP stakeholders have identified ease of application, surface appearance, and cure time as performance requirement for selection of a new coating system. The dry-to-touch results will provide information on the drying time required before another coating may be applied. The pot life test will be used to determine the viscosity increase of a mixed multi-component liquid coating over a specified time. Non-liquid coatings (i.e., MWAS, powder coating, and film technology) are exempt from the pot life and dry-to-touch test requirement. The acceptance criteria for the screening tests are summarized in Figure 8.

Screening Tests	Test Method	Acceptance Criteria
Ease of Application	None	Smooth coat, with acceptable appearance, no runs, bubbles or sags. Ability to cover the properly prepared/primed substrate with a single coat (one-coat hiding ability).
Surface Appearance	ASTM D 523-89 ASTM D 2244-93	No streaks, blistering, voids, air bubbles, cratering, lifting, blushing, or other surface defects/irregularities. No micro-cracks observable at 10X magnification. Gloss and color should match FED-STD-595B color chips.
Pot Life (Viscosity) Test	ASTM D 1200-94	<p><i>Procedure A - High Solids Coatings</i> Viscosity of both test batches shall not exceed 60 seconds after 4 hours of continuous mixing in a closed container maintained at 75± 5°F (Batch 1) and 95± 5°F (Batch 2). The admixed materials must still be sprayable 4 hours after mixing.</p> <p><i>Procedure B - Waterborne Coatings</i> Coating viscosity shall not exceed admix viscosity by more than 15 seconds after 4 hours, with no gelling of the admixed coating after 6 hours.</p>
Dry-To-Touch (Sanding)	None	No rolling or scribing during sanding, and "easy" sanding (as evaluated by technician) no more than 12 hours after application.
Cure Time (MEK Solvent Rub)	ASTM D 4752-95	No effect on surface or coating on the cloth (Resistance Rating 5).

Figure 8. Screening Tests Acceptance Criteria for Candidate SE Coatings/Coating Systems

The coatings that meet the screening tests will be subjected to the common tests, which represent more in-depth testing required to validate the coating systems. The common tests include removability, repairability, accelerated weathering, filiform corrosion resistance, X-cut adhesion, flexibility, and accelerated storage stability. Evaluating the relative removal ease for a candidate alternate coating system after aging is necessary for predicting the effectiveness of field maintenance operations. The filiform corrosion resistance test is required to ensure the candidate coating(s) provide the necessary corrosion protection. This test is normally not required for topcoating but is included to address self-priming topcoats. The acceptance criteria for the common test results are summarized in Figure 9 (see page 8).

There are also extended tests that are required by various agencies in order to validate a potential alternative for specific mission requirements. The extended tests required by the Air Force for validating a coating/coating system include the cyclic corrosion resistance and fluid resistance tests. The cyclic corrosion resistance test evaluates the ability of a coating system to prevent corrosion when exposed to corrosive conditions. The fluid resistance test measures the degradation of the coating adhesion and hardness as a result of prolonged contact with specified common fluids. Figure 10 (see page 8) summarizes the extended tests required by the participating services for selected coating/coating systems.

Although laboratory testing is useful to compare the relative performance of candidate test coating systems when exposed to identical simulated environments, exposure to authentic field environments is necessary to establish high levels of confidence in coating performance during actual service. Therefore, all participants have agreed that coating a fielded test articles is a performance requirement. The field evaluations are intended to compare the performance of candidate test coatings with current coatings when applied to powered and non-powered SE in an operational environment. The field evaluations will be performed after the laboratory tests are completed using only those candidate coatings that meet the acceptance criteria of the screening and common tests. During the field evaluations, one half of the SE unit will be coated with the candidate coating system and the remaining half will be coated with a selected control system (listed in Figure 7). Field evaluations for the Air Force will be conducted either at Hurlburt AFB, Patrick AFB, or Eglin AFB.

Common Tests	Test Method	Acceptance Criteria
Removability	ASTM D 523-89 ASTM D 2244-93 ASTM G 26-96, Test Method 1	Less than one minute to penetrate to substrate.
Repairability	ASTM D 523-89 ASTM D 2244-93 ASTM D 3359-92a	Ease of removal and replacement of damaged areas of the test coatings, color matching of aged versus new material. No streaks, blistering, voids, air bubbles, over-spray "halo", cratering, lifting, blushing, or other surface irregularities. No peel away of the repaired coating during the dry tape adhesion test.
Accelerated Weathering	ASTM G 26-96, Test Method 1 ASTM D 523-89 ASTM D 2244-93	Color change performance < one unit (ΔE) @ 500 hrs.
Filiform Corrosion Resistance	ASTM 2803-93, Procedure C	No filiform corrosion extending beyond 1/4-inch from the scribe lines with the majority of filaments less than 1/8-inch.
X-Cut Adhesion by Tape Test	ASTM D 3359-97, Test Method A	Candidate coating performs as well or better than control coatings greater than or equal to 4a as specified in ASTM 3359-97.
Mandrel Bend Flexibility	ASTM D 522-93a, Test Method B	No peeling or delamination from the substrate and no cracking greater than 1/4-inch from the edges.
Accelerated Storage Stability	ASTM D 1849-95	No skinning, grains, lumps, of the coating, pressure buildup, or corrosion on the container, odor of spoilage or cloudy appearance of any catalyst.

Figure 9. Common Tests Acceptance Criteria for Candidate SE Coatings/Coating Systems

Laboratory testing and analysis is anticipated to be completed in March 2001 and the field testing and final JTR will be completed in Sept 2002. The data obtained from this project will be transitioned not only into DoD and NASA organizational and depot overhaul locations, but into the Original Equipment Manufacturer (OEM) coating processes for new acquisitions of SE.

Conclusion

This project has the potential to substantially decrease VOC emissions and operating costs associated with coating SE in depot and field-level activities. Preliminary cost estimates indicate a total cost avoidance of roughly \$150/gallon to \$200/gallon by transitioning from high-VOC topcoats and primers to high-solids coatings, waterborne coatings, and primerless topcoats. Significant cost savings are also anticipated from implementing the other identified technologies (i.e., film technology, MWAS, and powder coatings). The final cost avoidance and actual savings data will become available upon project completion.

Extended Tests	Air Force	Army	Navy	NASA
Tensile (Pull-Off) Adhesion				✓
Abrasion Resistance				✓
18-Month Marine Environment				✓
Cyclic Corrosion Resistance	✓	✓		✓
SO ₂ Corrosion Resistance			✓	
B 117 Salt Fog Corrosion Resistance			✓	
Accelerated Weathering			✓	
Fluid Resistance	✓	✓	✓	
CARC Tests for HD and GD Agents		✓		
DS2 Decontaminant Resistance		✓		
Fungus Resistance		✓		
Infrared Reflectance		✓		
Acid Resistance		✓		
Specular Reflectance for All Camouflage Colors		✓		
Chromaticity		✓		

Figure 10. Extended Tests for Candidate SE Coatings/Coating Systems

For additional information regarding this project, please contact Ms. Debora Meredith, HQ AFMC/LGP-EV at DSN 787-7805 or Mr. Thomas Lorman, HQ AFMC/LGP-EV at DSN 787-7693. ♦

OVERVIEW OF THE CLEAN AIR ACT (CAA)

The CAA was first passed in 1963 and was subsequently amended in 1965, 1967, 1970, 1977, and 1990. The CAA Amendments of 1970 had a significant impact on the federal regulatory effort. These amendments allowed EPA to establish and enforce National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. In addition, new industrial sources were to be controlled by standards that, at a minimum, met the New Source Performance Standards (NSPS) applicable to classes of industrial facilities.

The CAA includes citations and penalties that explain why compliance with its requirements is important. The administrative enforcement provisions allow EPA to impose administrative penalties up to \$200K. Field citations of up to \$5K/day per violation can be issued directly by EPA officials. In addition, failure to meet the CAA requirements may result in civil penalties of up to \$25K/day per violation. Criminal penalties, include up to \$250K and 5 years for individuals or \$500K for companies, or up to 15 years for knowing the violation and \$1M for companies.

Overview of the CAA of 1990

The objectives of Clean Air Act (CAA) Amendments of 1990 include the following:

- Improving ambient air quality and visibility,
- Reducing emissions of toxic and other air pollutants,
- Bringing all areas of the country into compliance with NAAQS,
- Reducing acid rain, and
- Providing an enforcement mechanism for the Montreal Protocol.

The states, together with EPA, will develop and implement State Implementation Plans (SIPs) that will include source and area requirements to reduce carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO_x), volatile organic compounds (VOCs), lead, and particulate matter (PM). EPA will continue to develop and issue national technology-based [e.g., Maximum Achievable Control Technology (MACT)] standards to reduce the quantity of toxic air pollutants emitted from process units. In addition, air toxic residual risk measures will be developed to demonstrate how effective the MACT standards are in protecting the public. Results that are expected to be achieved by air programs nationwide are summarized in Figure 11.

- By 2005, all areas will come into attainment with the NAAQS for CO, SO₂, NO₂, and lead.
- By 2005, visibility will improve nationwide. Visibility in Class I areas (e.g., national parks and wilderness areas) will improve by 10–30% from 1995 levels.
- By 2010, significant progress will be made in meeting the NAAQS for ozone, and all areas will come into attainment by no later than 2012.
- By 2010, significant progress will be made in meeting the NAAQS for PM and all areas will come into attainment by no later than 2012 for PM₁₀ and 2017 for PM_{2.5}.
- Emissions of the major precursors of acid rain will be reduced. By 2010, SO₂ emissions from utilities and industrial sources will be reduced by 10 million tons below the 1980 levels, and by 2000, oxides of nitrogen (NO_x) emissions from utilities and mobile sources will be reduced 2 million tons below 1980 levels.

Figure 11. Nationwide Goals of the CAA Program

Air Force installations will need to program for future air projects depending upon the particular state and local jurisdiction in which the installation is located. The primary mechanisms regulating air pollution emissions are the state air quality regulations. In addition, the installation's budgetary requirements will depend on the types of activities that occur or are planned on-base. In general, the air regulations are source- and activity-specific. Examples of the types of sources and activities that may require POM programming are summarized in Figure 12.

- Steam generating units (e.g., boilers and turbines)
- Fuel burning units (e.g., internal and external combustion engines)
- Municipal waste combustors (MWCs)
- Incinerators
- Gasoline dispensing facilities
- Activities involving chlorofluorocarbons (CFCs) and halons
- Cleaning/Degreasing operations
- Painting and paint removal activities
- Aerospace vehicles or component units
- Mobile sources (e.g., cars, trucks, and airplanes)

Figure 12. Sources/Activities Regulated by the CAA

The costs to meet new air requirements for air emission sources and activities depend on the specific circumstances at each installation. Generally, compliance costs range from as little as \$1K or less for some projects to as much as \$1M for others. **Continued on page 23**

DEPARTMENT OF DEFENSE (DOD) CLEAN AIR ACT (CAA) SERVICES STEERING COMMITTEE (SSC)

During a Defense Environmental Policy Council Meeting held in February 1991, the Department of Defense (DoD) Components established the Clean Air Act (CAA) Services Steering Committee (SSC). The Deputy Assistant Secretary of the Navy (Environment and Safety) (DASN(ES)) was designated as the DoD Executive Agent. The DASN(ES) designated the Chief of Naval Operations, Environment Safety and Occupational Health (CNO N45) to chair the SSC and execute the operations and functions of the SSC. The committee is chaired by Mr. Ron Tickle, CNO N457, and meets every other month.

Figure 13 provides a listing of current SSC members. These senior military or civilian officials of the Army, Air Force, Navy, Marine Corps, and Defense Logistics Agency have responsibilities for their air quality management program and the ability to recommend resources and policy affecting air quality issues to appropriate authorities within their Service or DoD component. Representatives from non-DoD Federal agencies/departments also participate in the SSC meetings and serve as members of subcommittees and workgroups.

Name, Agency	Phone	FAX	Email
David Hoard, SAF/GCN	(703) 693-7315	(703) 693-1567	hoardd@pentagon.af.mil
Gary McDougall, AFLSA/JACE	(703) 696-9091	(703) 696-9184	gary.mcdougall@pentagon.af.mil
Maj Walter Roberts, AFLSA/JACE	(703) 696-9187	(703) 696-9184	walter.roberts@pentagon.af.mil
Sam Rupe, SAF/GCN	(703) 696-5240	(703) 696-0185	srupe@afbda1.hq.af.mil
Col Ed Stern, SAF/MIQ	(703) 614-8458	(703) 614-2884	sterne@pentagon.af.mil
Capt Mark Zimmerhanzel, AF ILEVQ	(703) 604-0648	(703) 604-3740	Mark.zimmerhanzel@pentagon.af.mil

POCs for Air National Guard, Army, Army National Guard, Coast Guard, DLA, DoD, DOE, Marine Corps, NASA, National Guard, Navy and Postal Service can be found on the MONITOR web site.

Figure 13. Air Force Services Steering Committee Points of Contact (7/14/00)

The group has been chartered to execute the following responsibilities:

- Coordinate the efforts of the DoD Components by sharing information on CAA initiatives;
- Develop technical, legal and policy analysis of CAA compliance requirements, including rulemakings;
- Establish subcommittees to monitor and recommend actions on specific CAA issues;
- Propose technical guidance on compliance with emerging CAA issues; and
- Develop and recommend policy and legislation on CAA issues.

The SSC is also chartered to establish Technical Subcommittees and Workgroups to examine specific CAA issues. Each DoD Component with an interest in the issue has nominated a knowledgeable individual from that DoD Component to serve on the subcommittee. The SSC will assign one DoD Component as the subcommittee lead. The subcommittee/workgroup will report on their findings and recommendations as well as provide periodic status reports to the SSC. The existing SSC Technical areas and subcommittees are listed in Figure 14. Additional details regarding the activities of these sub-committees can be found in the Denix DoD Menu Home page.

For further information regarding the DoD CAA SSC, please contact David Hoard, SAF/GCN at (703) 693-7315 or Sam Rupe, SAF/GCN at (703) 696-5240. ♦

- ➔ Hazardous Air Pollutants/NESHAPs (see related article on [page 11](#))
- ➔ Title V Permits/New Source Review
- ➔ Ozone/Particulate Matter/Regional Haze
- ➔ General Conformity
- ➔ Vehicle Inspection & Maintenance
- ➔ Emission Reduction Credits/Emission Trading
- ➔ Prescribed Burning
- ➔ Industrial Combustion Coordinated Rulemaking
- ➔ Global Climate Change
- ➔ Fines and Penalties
- ➔ Alternative Fuel Vehicles
- ➔ Nonroad Engines
- ➔ DoD Measures of Merit for Air

Figure 14. Summary of SSC Technical Areas/Subcommittees

OVERVIEW OF THE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP)

This article provides a brief summary of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) that have been and will be promulgated in the future under Section 112 of the Clean Air Act. This information was gleaned from the Services Steering Committee's HAP Status Binder Web Site at <http://www.denix.osd.mil/HAP>. For further information regarding future NESHAPs visit the preceding web site or contact a HAP Subcommittee Member listed in Figure 15.

FINAL NESHAPs

National Emission Standards for Hazardous Air Pollutants for Aerospace Manufacturing and Rework Facilities, 40 CFR 63 Subpart GG:

Name, Agency	Phone	Email
Maria Del C. Bayon, NASA JE	(202) 358-1092	maria.bayon@hq.nasa.gov
Kathy Ellis, CNO N457	(703) 602-2568	ellis.kathy@hq.navy.mil
Jeanette Howard, IERA/RSEQ	(210) 536-4991	jeanette.howard@brooks.af.mil
Richard Jaynes, DAJA-EL	(703) 696-1569	richard.jaynes@hqda.army.mil
Paul Josephson, AEC	(410) 436-1205	pajoseph@aec.apgea.army.mil
Ken Malmberg, USCG	(202) 267-6214	kmalmberg@comdt.uscg.mil
Felix Mestey, NAVFAC	(202) 685-9313	mesteyf@navfac.navy.mil
Drek Newton, NFESC (Chair)	(805) 982-3903	newtonda@nfesc.navy.mil
Elmer Ransom, USMC LFL	(703) 695-8232	ransomew@hqmc.usmc.mil
Dr. David Reed, USA-CHPPM	(410) 436-8153	david.reed@apg.amedd.army.mil
Walter Roberts, AFLSA/JACE	(703) 696-9186	walter.roberts@pentagon.af.mil
Lisa Trembly, NFESC	(805) 982-3567	tremblyla@nfesc.navy.mil
Mark Zimmerhanel, AF/ILEVQ	(703) 604-0648	mark.zimmerhanel@pentagon.af.mil

Figure 15. Department of Defense Hazardous Air Pollutants (HAP) Subcommittee Contacts (5/25/00)

Proposed Rule: 6 June 1994 (59 FR 29216)

Final Rule: 1 Sept 1995 (60 FR 45948)

Affected Sources: Major Sources of Hazardous Air Pollutants (HAPs)

Compliance Status Reporting Deadline: 1 May 99 for most existing sources and 60 days after completion of relevant compliance demonstrations or as required by Title V permit. Ongoing activity includes annual and semi-annual reporting.

Cleaning, surface coating, repainting; and maskant operations associated with the manufacture, rework, maintenance, and repair of aerospace vehicles and components are affected by this regulation. An aerospace vehicle or component means any fabricated part, processed part, assembly of parts, or completed unit, with the exception of electronic components, of any aircraft including but not limited to airplanes, helicopters, missiles, rockets, and space vehicles. There are numerous exemptions for each type of process that is regulated. EPA's Implementation Guide (EPA-456/R-97-006) contains an excellent overview of the requirements of the rule (<http://www.epa.gov/ttn/uatw/aerosp/aeropg.html>).

Although specialty coatings are exempt under this NESHAPs, they are regulated by the Final Aerospace Control Techniques Guidelines (CTG), which states must implement in ozone nonattainment areas. Any aerospace vehicles or component stationed, maintained, or reworked on major HAP source installations are potentially affected by this rule. Routine squadron level maintenance may be affected if located in a major HAP source. This rule affects new and existing aerospace coating, cleaning, and repainting operations. Although most military facilities are achieving compliance using compliant coatings and approved solvents, the recordkeeping requirements are still burdensome.

Chromium Electroplating and Anodizing NESHAPs – 40 CFR 63 Subpart N

Proposed Rule: 16 Dec 1993 (59 FR 65768)

Final Rule: 25 Jan 1995 (60 FR 49488)

Affected Sources: Major and Area Sources of Hazardous Air Pollutants (HAPs)

Compliance Status Reporting Deadline: 25 Jan 97 for existing hard chromium electroplating and anodizing operations. All new and reconstructed sources must comply immediately upon start up. Ongoing status reports are due for major sources semi-annually and for area sources annually.

This rule applies to every chromium electroplating and chromic anodizing tank in the United States and its Territories. All existing sources performing hard chromium electroplating and chromium anodizing must comply with the emissions limitations by 25 Jan 1997. All new and reconstructed sources must comply immediately upon start up. Owners and operators of chromium electroplating and anodizing sources are subject to work practice standards, which require them to prepare an operation and maintenance (O&M) plan to be implemented no later than the compliance date. The O&M plan shall be incorporated by reference into the source's Title V permit and include the following elements:

1. Specify the O&M criteria of the affected source, the add-on air pollution control device (if present), and the process and control system monitoring equipment. The plan shall include a standardized checklist to document the operation and maintenance of this equipment.
2. For sources using an add-on air pollution control device or monitoring equipment for compliance, the plan shall incorporate the work practice standards for that device or monitoring equipment (i.e., packed-bed scrubber (PBS), composite mesh-pad (CMP), fiber-bed mist eliminator).

Owners or operators of affected sources are required to keep the records to document compliance with these standards. Records include those associated with work practice standards, performance (initial compliance) test results, compliance monitoring data, duration of exceedance, and rectifier capacity or amp-hr records to prove that the facility is a small source (if applicable).

Halogenated Solvent Cleaners NESHAPs – 40 CFR 63 Subpart T

Proposed Rule: 29 Nov 93 (59 FR 62566)

Final Rule: 2 Dec 94 (59 FR 61801)

Affected Sources: Major and Area Sources of Hazardous Air Pollutants (HAPs)

Compliance Status Reporting Deadline: 2 Dec 97 for existing sources (constructed before 29 Nov 93) and as soon as practical before startup for new sources but no later than 31 Jan 95. Ongoing reporting requirements are operation specific. Annual reports are due by 1 Feb following reporting year.

This NESHAPs regulates both major and area sources in this category, which means that all halogenated solvent cleaning machines (SCMs), are affected. This rule applies to each individual batch cold, batch vapor, in-line cold, and in-line vapor SCM, that used any solvent as a cleaning or drying agent which contains greater than 5 percent by weight of the following chemicals:

- methylene chloride
- perchloroethylene
- trichloroethylene
- 1,1,1-trichloroethane
- carbon tetrachloride
- chloroform
- any combination of these halogenated HAP solvents.

Buckets, pails and beakers with capacities of 2 gallons or less are not considered solvent cleaning machines. Wipe cleaning activities, such as using a rag containing halogenated solvents or a spray cleaner containing halogenated solvents are not covered under the provision of this subpart.

FUTURE NESHAPs

Engine Testing Facilities (ETF) and Rocket Motor Test Firing NESHAPs (Pre-Rule Stage)

Proposed Rule: 15 Feb 01 (Est.)

Final Rule: 15 May 02 (Est.)

Affected Sources: TBD

Compliance Status Reporting Deadline: If the final ETF rules are not issued by 15 May 02, major source installations with ETF will be required to apply for a case-by-case Maximum Allowable Control Technology (MACT) determination.

EPA is developing two separate NESHAPs, one for Rocket Motor Test Firing and the other for Engine Testing Facilities (ETF). EPA has cancelled contractor support for the development of these regulations and hopes to work with stakeholders in house to complete MACT determinations and develop the final rules in-house.

The services have been working closely with EPA as these rules develop. EPA has not yet indicated if the rule will be limited to major HAP sources or both major and area HAP sources. The initial NESHAP requirements for existing sources should not be very burdensome. For most ETF subcategories, the MACT floor for existing sources will be no control expect for possibly work practice standards. The MACT floor is the minimum control level EPA must impose regardless of cost. The initial NESHAP requirements for new sources could be substantial since the MACT floor must equal a level achieved by the best-controlled similar source.

In February 1999, the Services Steering Committee (SSC) submitted information to EPA on 138 military aircraft engine test cells located on 46 military installations. The SSC also submitted air toxic emission factors for JP-5, and JP-8 fuel combustion in gas turbine engines. EPA has also collected information related to the Rocket NESHAPs from Hill AFB, Arnold Engineering Development Center (AEDC), and Edwards AFB.

Miscellaneous Metal Part and Products (MMPP) NESHAPs (Surface Coatings)

Proposed Rule: 15 Feb 01 (Est.)

Final Rule: 15 Feb 02 (Est.)

Affected Sources: TBD

The MMPP NESHAPs is scheduled for proposal on 15 Feb 01. EPA has not yet indicated whether this rule will be limited to major HAP sources or apply to both major and area HAP sources. The intent of this source category is to cover sources not addressed by other coating rules. This rule will not affect operations specifically “exempted” by other NESHAPs but may affect operations that are not covered by other NESHAPs. It is anticipated that the rule will take a similar approach to the Aerospace and Shipbuilding NESHAPs. For coatings, the use of low VOC/HAP coatings will be the main compliance option, although they will probably allow emission control devices for where alternative coatings cannot be used. Two or three stage filters will likely be required on booths where organic HAPs were being applied or removed. The use of HAP containing chemical strippers will strongly be discouraged, although a control device option may be available.

This rule potentially affects any coating operation performed on a metal surface (excluding stationary structures) that is not covered or specifically exempted by another NESHAP source category. Other NESHAP source categories that affect metal surface coating operations include but are not limited to:

- Aerospace Manufacturing and Rework
- Shipbuilding and Repair
- Large Appliances
- Auto and Light Duty Trucks

Military sources that could potentially affected by this rule include:

- Tactical vehicles
- Heavy duty non tactical vehicles
- Parts of aerospace vehicles, ships, appliances, and automobile parts that are not covered or specifically exempted by their respective NESHAPs.

Paint Stripping Operations NESHAPs

Proposed Rule: 15 May 01 (Est.)

Final Rule: 15 May 02 (Est.)

Affected Sources: TBD

The Paint Stripping Operations NESHAP for major HAP sources was scheduled to be issued by 15 Nov 00 but will either be issued in mid to late 2002 or not at all. EPA has no money in FY00 to work on this rule. So far they have not identified a significant major source paint stripping operation. Regardless of what EPA decides to do with the major source rule, they will definitely issue a NESHAP for area source paint stripping operations in 2004 as part of their Integrated Urban Air Toxics Strategy.

These rules potentially could affect military depainting operations that are not covered by another NESHAP source category. NESHAPs that already cover depainting operations include but are not limited to:

- Aerospace Manufacturing and Rework Facilities NESHAP

Future NESHAPs that will likely cover depainting operations include but are not limited to:

- Miscellaneous Plastic Parts and Products NESHAP
- Miscellaneous Metal Parts and Products NESHAP

The impact of these rules should be minimal because most significant depainting operations are or will be covered by other NESHAPs.

FINAL CTGs

Aerospace Manufacturing & Rework Facilities (Surface Coating and Cleaning) Control Techniques Guidelines (CTG) Documents (CAA Section 183 Federal Ozone Measures)

Final Document: 27 Mar 98 (63 FR 15006)

Compliance Deadline: *Varies depending on State and local agencies issue rules implementing these requirements in their moderate, serious, or severe ozone non attainment areas.*

The CTG is not a rule but rather a control technology information document for States to develop their own VOC rules. The Aerospace Manufacturing and Rework Operations NESHAP focuses on reduction of HAP emissions. However, the control techniques required by the NESHAP also result in reductions of VOC emissions. The control techniques required by the NESHAP are very similar to those presented in the CTG.

The NESHAP sets limits for maximum HAP and VOC content for topcoats, primers, maskants, clean-up solvents, and cleaning operations. The CTG establishes presumptive RACT limits for VOCs.

Two major difference between the NESHAP and CTG are:

1. The CTG includes requirements for specialty coatings, the NESHAP does not.
2. The NESHAP includes requirements for depainting operations, the CTG does not.

The principal technique used to control VOC emissions from coating application and cleaning is product substitution, which eliminates or reduces the generation of emissions.

The requirements for limit of VOC content of specialty coatings are listed in the Table 1.

Table 1. Specialty Coatings VOC Content Limits (g/L)

Coating Type	Description	VOC Content Limit (g/L)*
Ablative Coating	A coating that chars when exposed to open flame or extreme temperatures, as would occur during the failure of an engine casing or during aerodynamic heating. The ablative char surface serves as an insulative barrier, protecting adjacent components from the heat or open flame.	600
Adhesion Promoter	A very thin coating applied to a substrate to promote wetting and form a chemical bond with the subsequently applied material.	890
Adhesive Bonding Primers	A primer applied in a thin film to aerospace components for the purpose of corrosion inhibition and increased adhesive bond strength by attachment. Primers cured at 250°F or below Primers cured above 250°F	850 1030
Antichafe Coating	A coating applied to areas of moving aerospace components that may rub during normal operations or installation.	660
Bearing Coating	A coating applied to an antifriction bearing, a bearing housing, or the area adjacent to such a bearing in order to facilitate bearing function or to protect base material from excessive wear. A material shall not be classified as a bearing coating if it can also be classified as a dry lubricative material or a solid film lubricant.	620
Caulking and Smoothing Compounds	Semi-solid materials, which are applied by hand application methods and are used to aerodynamically smooth exterior vehicle surfaces or fill cavities such as bolt hole accesses. A material shall not be classified as a caulking and smoothing compound if it can also be classified as a sealant.	850
Chemical Agent-Resistant Coating (CARC)	An exterior topcoat designed to withstand exposure to chemical warfare agents or the decontaminants used on these agents.	550
Clear Coating	A transparent coating usually applied over a colored opaque coating, metallic substrate, or placard to give improved gloss and protection to the color coat. In some cases, a clearcoat refers to any transparent coating without regard to substrate.	720

Table 1. Specialty Coatings VOC Content Limits (g/L) (continued)

Coating Type	Description	VOC Content Limit (g/L)*
Commercial Exterior Aerodynamic Structure Primer	A primer used on aerodynamic components and structures that protrude from the fuselage, such as wings and attached components, control surfaces, horizontal stabilizers, vertical fins, wing-to-body fairings, antennae, and landing gear and doors, for the purpose of extended corrosion protection and enhanced adhesion.	650
Commercial Interior Adhesive	Materials used in the bonding of passenger cabin interior components. These components must meet the FAA fireworthiness requirements.	760
Compatible Substrate Primer	Either compatible epoxy primer or adhesive primer. <i>Compatible epoxy primer</i> - a primer that is compatible with the filled elastomeric coating and is epoxy based. The compatible substrate primer is an epoxy-polyamide primer used to promote adhesion of elastomeric coatings such as impact-resistant coatings. <i>Adhesive primer</i> - a coating that (1) inhibits corrosion and serves as a primer applied to bare metal surfaces or prior to adhesive application, or (2) is applied to surfaces that can be expected to contain fuel. Fuel tank coatings are excluded from this category.	780
Corrosion Prevention Compound	A coating system that provides corrosion protection by displacing water and penetrating mating surfaces, forming a protective barrier between the metal surface and moisture. Coatings containing oils or waxes are excluded from this category.	710
Cryogenic Flexible Primer	A primer designed to provide corrosion resistance, flexibility, and adhesion of subsequent coating systems when exposed to loads up to and surpassing the yield point of the substrate at cryogenic temperatures (-275°F and below).	645
Cryoprotective Coating	A coating that insulates cryogenic or subcooled surfaces to limit propellant boil-off, maintain structural integrity of metallic structures during ascent or re-entry, and prevent ice formation.	600
Cyanoacrylate Adhesive	A fast-setting, single component adhesive that cures at room temperature. Also known as "super glue."	1,020
Dry Lubricant Material	A coating consisting of lauric acid, acetyl alcohol, waxes, or other noncross linked or resin-bound materials that act as a dry lubricant.	880
Electric or Radiation-Effect Coating	A coating or coating system engineered to interact, through absorption or reflection, with specific regions of the electromagnetic energy spectrum, such as the ultraviolet, visible, infrared, or microwave regions. Uses include, but are not limited to, lightning strike protection, electromagnetic pulse (EMP) protection, and radar avoidance. Coatings that have been designated as "classified" by the Department of Defense are exempt.	800
Electrostatic Discharge and Electromagnetic Interference (EMI) Coating	A coating applied to space vehicles, missiles, aircraft radomes, and helicopter blades to disperse static energy or reduce electromagnetic interference.	800
Elevated-Temp Skydrol-Resistant Commercial Primer	A primer applied primarily to commercial aircraft (or commercial aircraft adapted for military use) that must withstand immersion in phosphate-ester (PE) hydraulic fluid (Skydrol 500b or equivalent) at the elevated temperature of 150°F for 1,000 hours.	740
Epoxy Polyamide Topcoat	A coating used where harder films are required or in some areas where engraving is accomplished in camouflage colors.	660
Fire-Resistant (interior) Coating	For civilian aircraft, fire-resistant interior coatings are used on passenger cabin interior parts that are subject to the FAA fireworthiness requirements. For military aircraft, fire-resistant interior coatings are used on parts that are subject to the flammability requirements of MIL-STD-1630A and MIL-A-87721. For space applications, these coatings are used on parts that are subject to the flammability requirements of SE-R-0006 and SSP 30233.	800
Flexible Primer	A primer that meets flexibility requirements such as those needed for adhesive bond primed fastener heads or on surfaces expected to contain fuel. The flexible coating is required because it provides a compatible, flexible substrate over bonded sheet rubber and rubber-type coatings as well as a flexible bridge between the fasteners, skin, and skin-to-skin joints on outer aircraft skins. This flexible bridge allows more topcoat flexibility around fasteners and decreases the chance of the topcoat cracking around the fasteners. The results is better corrosion resistance.	640
Fuel Tank Adhesive	An adhesive used to bond components exposed to fuel and must be compatible with fuel tank coatings.	620
Nonstructural Adhesive	An adhesive that bonds nonload bearing aerospace components in noncritical applications and is not covered in any other specialty adhesive categories.	360
Rocket Motor Bonding Adhesive	An adhesive used in rocket motor bonding applications.	890

Once implemented in the States, this CTG will affect military installations that are located in ozone nonattainment areas. Any aerospace vehicles or components stationed, maintained, or reworked on these installations may be affected by the control techniques presented in the CTG. Although most military facilities can achieve compliance using compliant coatings and approved solvents, the recordkeeping and reporting requirements will still be burdensome.

*VOC content limits are "less water and exempt solvents," which means that when calculating the VOC concentration you subtract the water and exempt solvents (i.e., acetone, methylene chloride and other chemicals exempt from the definition of VOC from both the numerator and denominator when calculating the VOC content. ♦

OVERVIEW OF THE CHROMIUM ELECTROPLATING NESHAP

On January 1995 (60 FR 4948), the Environmental Protection Agency (EPA) promulgated the Chromium NESHAP Standard. This rule applies to every chromium electroplating and chromic acid anodizing tank in the United States and its Territories. Table 2 summarizes the federal emission standards. For some states, the chromium electroplating and anodizing standards are more stringent than the federal standards.

Decorative chromium electroplating and chromium anodizing sources must comply with either: 1) surface tension limit; or 2) an emission concentration limit.

Although not shown in the table, decorative chromium electroplating sources using a *trivalent* chromium bath have three compliance options: 1) use a wetting agent; 2) comply with a surface tension limit; or 3) comply with an emission limit. These emission limitations apply only during tank operation, including periods of startup and shutdown.

The emission limitation for all *new and existing* hard chromium electroplating tanks that are located at *large* facilities is based on the use of a composite mesh-pad system. A large facility has a maximum cumulative potential rectifier capacity greater than or equal to 60 million ampere-hours per year (amp-hr/yr).

The emission limitation for *existing* hard chromium electroplating tanks that are located at *small* facilities is based on the use of a packed-bed scrubber. A small facility has a maximum cumulative potential rectifier capacity less than 60 million amp-hr/yr. Alternatively, *existing* facilities that have rectifier capacities greater than 60 million amp-hr/yr can still comply with the small facility emission limit if the actual annual amperage can be documented (using non-resettable totalizing amp-hr meters) to be less than 60 million amp-hr/yr.

For all *existing and new* decorative chromium electroplating and chromium anodizing, the standard is based on the use of fume suppressants.

Work Practice Requirements

Owners and operators of chromium electroplating and anodizing sources are subject to work practice standards, which require them to prepare an operation and maintenance (O&M) plan to be implemented no later than the compliance date. Decorative chromium electroplating sources using a trivalent chromium bath with a wetting agent are exempt from the work practice requirements. The O&M plan shall be incorporated by reference into the source's title V permit and shall include the following elements:

1. The plan shall specify the operation and maintenance criteria for the affected source, the add-on air pollution control device (if such a device is used to comply with the emission limits), and the process and control system monitoring equipment, and shall include a standardized checklist to document the operation and maintenance of this equipment;
2. For sources using an add-on air pollution control device or monitoring equipment to comply with this subpart, the plan shall incorporate the work practice standards for that device or monitoring equipment as identified in Table 3 (see page 17). The work practice standards do not apply to sources that comply with a surface tension standard.

Monitoring Requirements

Table 4 (see page 18) summarizes the monitoring requirements. Any source complying with an emission concentration limit must perform an emission test to demonstrate initial compliance. Decorative chromium electroplating or chromium anodizing sources complying with the surface tension limit are exempt from the initial compliance emission tests.

Table 2. Standards for Chromium Plating and Anodizing Tanks

Type of Tank	Federal Emissions Limitations	
	Small Facility	Large Facility
Hard Chromium Plating Tanks		
All existing tanks	0.03 mg/dscm (1.3 x 10 ⁻⁵ gr/dscf)	0.015 mg/dscm (6.6 x 10 ⁻⁶ gr/dscf)
All new tanks	0.015 mg/dscm (6.6 x 10 ⁻⁶ gr/dscf)	0.015 mg/dscm (6.6 x 10 ⁻⁶ gr/dscf)
Decorative Chromium Plating Tanks Using a Chromic Acid Bath		
All new and existing tanks	0.01 mg/dscm (4.4 x 10 ⁻⁵ gr/dscf) or 45 dynes/cm (3.1 x 10 ⁻³ lb _f /ft)	
Chromium Anodizing Tanks		
All new and existing tanks	0.01 mg/dscm (4.4 x 10 ⁻⁵ gr/dscf) or 45 dynes/cm (3.1 x 10 ⁻³ lb _f /ft)	

Table 3. Summary of Work Practice Standards

Work Practice Standard	Frequency
Control: Packed-bed scrubber (PBS)	
1 Visually inspect to ensure there is proper drainage, no chromic acid buildup on the packed beds, and no evidence of chemical attack on the structural integrity of the device.	Quarterly
2 Visually inspect back portion of the chevron blade mist eliminator to ensure that it is dry and there is no breakthrough of chromic acid mist.	Quarterly
3 Same as 2 above.	Quarterly
4 Add fresh makeup water to the top of the packed bed. ^{a,b}	Whenever makeup water is added
Control: Composite mesh-pad (CMP) system or combination PBS/CMP system	
1 Visually inspect to ensure there is proper drainage, no chromic acid buildup on the pads, and no evidence of chemical attack on the structural integrity of the device.	Quarterly
2 Visually inspect back portion of the mesh pad closest to the fan to ensure there is no breakthrough of chromic acid mist.	Quarterly
3 Visually inspect ductwork from tanks to the control device to ensure there are no leaks.	Quarterly Per mfr.
4 Perform washdown of the composite mesh-pads per manufacturer recommendations.	
Control: Fiber-bed mist eliminator^c	
1 Visually inspect fiber-bed unit and prefiltering device to ensure there is proper drainage, no chromic acid buildup in the units, and no evidence of chemical attack on the structural integrity of the devices.	Quarterly
2 Visually inspect ductwork from tanks to the control device to ensure there are no leaks.	
3 Perform washdown of fiber elements per manufacturer recommendations	Quarterly Per mfr.
Control Technique: Air pollution control device not listed in rule	
To be proposed by the source for approval by the Administrator.	As approved
Monitoring Equipment: Pitot tube	
Backflush with water, or remove from the duct and rinse with fresh water. Replace in the duct and rotate 80 degrees to ensure that the same zero reading is obtained. Check pitot tube ends for damage. Replace pitot tube if cracked or fatigued.	Quarterly
Monitoring Equipment: Stalagmometer	
Follow manufacturers recommendations.	Per mfr.

a If greater than 50 percent of the scrubber water is drained (e.g., for maintenance purposes), makeup water may be added to the scrubber basin.

b For horizontal-flow scrubbers, top is defined as the section of the unit directly above the packing media such that the makeup water would flow perpendicular to the air flow through the packing. For vertical-flow units, the top is defined as the area downstream of the packing material such that the makeup water would flow countercurrent to the air flow through the unit.

c Work practice standards for the control device installed upstream of the fiber-bed mist eliminator to prevent plugging do not apply as long as the work practice standards for the fiber-bed unit are followed.

Initial compliance emission tests must be conducted according to EPA approved methods. Continuous compliance is demonstrated by monitoring parameter(s) of the control technique used to comply with the emission limitation. Decorative chromium electroplating sources using a trivalent chromium bath with a wetting agent are exempt from the continuous monitoring requirements.

Recordkeeping and Reporting Requirements

Owners or operators of affected sources are required to keep the records to document compliance with these standards. Records include those associated with the work practice standards, performance (initial compliance) test results, compliance monitoring data, duration of exceedances, and rectifier capacity or amp-hr records to prove that facility is a small existing source, if applicable. Reports must also be submitted periodically. Table 4 identifies the reports that must be submitted and the reporting timeframes.

Table 4. Summary of Monitoring Requirements

Control Technique used to Comply	Initial Compliance Test	Parameter(s) for Continuous Compliance Monitoring	Frequency of Compliance Monitoring
Composite mesh-pad (CMP) system	Yes	Pressure drop across the unit	Daily
Packed-bed scrubber (PBS)	Yes	Velocity pressure at the inlet of the control system and pressure drop across the unit	Daily
Combination PBS/CMP system	Yes	Pressure drop across the unit	Daily
Fiber-bed mist eliminator	Yes	Pressure drop across the fiber-bed mist eliminator and the pressure drop across the upstream control device used to prevent plugging	Daily
Wetting agent-type fume suppressant to control surface tension	Yes (Unless the criteria of § 63.343(b)(2) are met)	Surface tension	Once every 4 hours ^a
Foam blankets	Yes	Foam thickness	Hourly ^a
Air pollution control device (APCD) not listed in rule	Yes	To be proposed by the source for approval by Administrator	N/A

^aFrequency can be decreased according to § 63.343(c)(5)(ii) and (c)(6)(ii) of subpart N.

Compliance Deadlines

All existing sources performing hard chromium electroplating and chromium anodizing must comply with the emission limitations by 25 Jan 97. All existing sources performing decorative chromium electroplating must comply with the emission limitations by 25 Jan 96. All new and reconstructed sources must comply immediately upon startup.

Hard Chromium Plating

On the basis of Navy emission test data, 70% of sources were able to comply with the new standards using existing control equipment. The remaining sources likely installed new control devices or process modifications to comply.

Chromic Acid Anodizing

Navy emission test data indicates that all chromic acid anodizing operations could easily comply with the new standards by using existing control devices or surface tension additives.

For further information regarding the Chromium Electroplating NESHAP Standard, please contact Mr. Drek Newton at (805) 982-3903.

This article can be found on the HAP Status Binder Web Site, DoD Menu, DENIX (www.denix.osd.mil/HAP).◆

HEXAVALENT CHROMIUM AIR EMISSIONS CONTROL FROM PLATING BATHS

Functional chromium electroplating shops must meet the Environmental Protection Agency's (EPA's) 1995 National Emissions Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks (Chromium Emissions MACT Standard). The use of a Wetting Agent Fume Suppressant (WAFS) was investigated for its usefulness in reducing chromium air emissions for functional chromium electroplating shops.

Fume suppressants are approved for use in the decorative chromium plating industry due to the success in reducing chromium air emissions. Functional or hard chromium plating has not used Fume Suppressant (FS) as an option due to quality concerns, such as pitting of the plating. The stack emissions testing, worker exposure testing and surface tension testing over the last four years has been documented by David Ferguson, USEPA.

Fume Suppressants

The use of a fume suppressant in the hard chromium plating baths has proved successful. A wetting agent type fume suppressant reduces the surface tension of the plating bath. Several plating options were evaluated to determine if pitting of the coating occurred when a fume suppressant was introduced to the process. Testing for newly formed pits was perhaps the most important aspect of the study. If pitting was discovered then testing was duplicated without the use of a fume suppressant. The latest generation of WAFS appears to have no adverse effect upon the integrity of the chromium plate during hard chrome plating operations.

Stack Emissions tests were performed to verify that FS would reduce air emissions to meet the 1995 MACT Standard in hard chromium plating facilities. These tests were based on the total chromium (hexavalent + trivalent) or hexavalent chromium concentrations. WAFS shows a marked decrease in the Hexavalent Chromium concentration. No pitting of the coating was discovered during testing. The effect of FS on porosity, adhesive strength of the coating, hardness and hydrogen embrittlement, was evaluated as well. Through this testing it was determined that fume suppressants did not adversely effect the overall integrity of the coating.

Benefits of WAFS

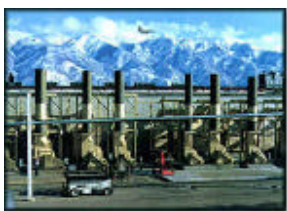
Considerable cost reduction in a facility can be achieved by the implementation of fume suppressants by eliminating the existing capitol cost of composite mesh pads.

Worker exposure to hexavalent chromium during normal operations with and without FS was evaluated. The fume suppressant reduced the over-tank chromium air-emissions 94-98%. The use of FS reduced emissions 64%. By implementing FS, cost and worker exposure to chromium emissions can be reduced, and the MACT standard can be met.

For more information, please contact David Ferguson, National Risk Management Research Laboratory, Phone: (513) 569-7518, Fax: (513) 569-7471.

Source: Proceedings of the Air & Waste Management Association's 93rd Annual Conference & Exhibition, Salt Lake City, Utah, June 2000. ♦

HILL AFB UPGRADES EMISSION CONTROL EQUIPMENT TO MEET CHROMIUM STANDARDS



Hill Air Force Base is located near Ogden, Utah and operates one of the last five remaining U.S.A.F. aircraft overhaul and maintenance bases in the continental United States. The plating facility covers 150,000 square feet with over 350 process tanks, and has been in operation since 1941. Like most older plating shops, the process tank ventilation and scrubbing systems were inefficient, and replacement was required to comply with future emission regulations for hexavalent chrome.

Preliminary plans and specifications were released in a Request For Proposal in mid-1990. HHI Corporation of Farmington, Utah was eventually selected as the Prime Contractor. Team members included Midwest Air Products Co., Inc. (Mapco) of Owosso, MI, and Conserve Engineering of Laguna Beach, CA. Their proposal recommended a promising chromic acid mist eliminator designed and developed by Mapco based on multiple-stage composite mesh pad technology, called the Enforcer III™. At that time Mapco was the only responding supplier who had achieved significant success with this type of equipment in chrome plating shops on systems as large as 50,000 CFM. The Mapco mesh pad mist eliminator offered many advantages, including dependability, low effluent production, low maintenance, low operating cost, low initial cost, and small footprint.

In early 1991 the first of three chromic acid mist eliminator systems was installed by HHI and tested by an independent testing firm. Test results indicated hexavalent chrome emissions of less than .0004 mg/amp hr., performance far better than the .006 mg/amp hr. requested by the Air Force. The final system was completed in the fall of 1991, 6 months ahead of schedule. All three chrome mist eliminators have been tested several times since and show average emission concentrations of 0.00019 mg/dscm, far below the current EPA MACT standard requirements.

(Source: <http://www.midwestair.com/casehistory.html>). ♦

NON-CHROMATE CONVERSION COATING

Reduction and elimination of chromate containing wastes is a major pollution prevention goal as chromium is a confirmed human carcinogen. One of the most pervasive uses of material containing chromate is in the treatment of aluminum with chromate conversion coatings (commonly called alodine). Chromate conversion coatings help prepare aluminum for the application of paint and they also provide a corrosion preventive barrier. In aircraft paint systems, chromate conversion coating are used in conjunction with modern epoxy primers that also contain chromate to guard against corrosion. Laboratory testing has shown that as long as chrome is contained in the primer, and the conversion coating does not entrap the chrome in the primer from the base metal, the corrosion protective properties of modern aircraft paint systems will suffer little.

A multi-year effort at Hill AFB has been undertaken to reduce or eliminate the use of chromate compounds in the paint preparation process for aircraft, especially F-16s. The non-chromate conversion coating project was funded by a Pollution Prevention Project. The Science and Engineering Laboratory at Hill was commissioned by Hill's Environmental Management directorate to conduct the study and manage the project. Nine tests were conducted and used to evaluate candidate products. These tests

include: uniform color, bonding in presence of known contaminants, corrosion resistance, ease of application, hydrogen embrittlement, kapton wire test, adhesion testing, flexibility, and surface analysis. Not all candidate materials were subjected to all the tests.

The laboratory tested four different products alleged to be non-chromate conversion coatings that would give a visual indication that the product was properly applied and the surface was prepared to accept primer and paint. As failures occurred and problems encountered, the various companies were allowed to make modifications to their products to try and pass the requirements. Testing proceeded until a particular material failed to meet the criteria and it was decided that further testing would be futile. Of the four products tested, three were eliminated early through laboratory testing. The fourth candidate, X-It PreKote™, was tested extensively against the current process. X-It PreKote™ performed better than chromate conversion coating in adhesion and flexibility tests. It performed equally well in other testing. In addition, it was found that X-It PreKote™ could eliminate the solvent wipe down and the acid brightener used in conventional paint preparation procedures. Use of X-It PreKote™ also reduces the need to sand anodized surfaces before repainting.

Operational tests have been conducted

on several aircraft and are ongoing. AETC used X-It PreKote™ on two aircraft in 1996. In March 1997 an F-16 was scuff sanded and repainted using X-It PreKote™ in the prep for paint process. In November 1997 two fully stripped F-16 aircraft had their right wings treated with X-It PreKote™ while the rest of the aircraft was treated with chromate conversion coating. These aircraft are in service at Eglin and at Homestead. Hill AFB and the owning units have examined each of the test aircraft. The results so far are very positive and no detrimental effects from the X-It PreKote™ have been discovered. As of September 1999, Hill AFB has painted over fifty aircraft using the X-It PreKote™ process. The F-16 SPO has approved the use of the X-It PreKote™ process in 1F-16-23 TO.

The study recommends expanded use of X-It PreKote™ to eliminate a major source of pollution and hazardous waste. It not only eliminates chromates; it decreases the use of solvents, detergents, and acid brighteners. The X-It PreKote™ process simplifies and reduces the paint preparation steps, saving time and money in painting aircraft.

For further information regarding this article, please contact Richard Buchi at (801) 775-2993.

Source: Plating & Surface Finishing Journal (www.aesf.org).◆

AIR PERMIT COMPLIANCE THROUGH POLLUTION PREVENTION AT AIR FORCE PLANT 44, TUCSON, AZ

Air Force Plant 44 in Tucson, AZ is owned by the Air Force and operated by Raytheon Missile Systems, producing missile systems for all branches of the Armed Services. Manufacturing and refurbishing processes include surface coating and corrosion control. An initial assessment of AFP 44s emission sources indicated that AFP 44 should be subject to the Aerospace NESHAP MACT. However, a joint Air Force and Raytheon Pollution Prevention Integrated Product Team had previously set as a major goal the reduction of Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs) using source elimination and reduction technologies. Several of the technologies implemented included powder painting, aqueous cleaners, and recycling solvents from paint gun cleaning. Based on these and other organizational changes, HAPs emissions facility wide were reduced to such an extent that synthetic minor conditions for the AFP 44 facility were crafted and issued through the joint efforts of PDEQ and EPA Region IX, avoiding the application of

Aerospace NESHAP MACT. AFP 44 has been operating as a Synthetic Minor since August 1998. The Pima County Department of Environmental Quality (PDEQ) has received delegation from the US EPA Region IX to enforce the Air Pollution Control Program in Tucson, including the Title V permit program. The ongoing compliance demonstration method for the synthetic minor conditions is based on the enhanced use of chemical purchase and MSDS databases. Compliance with the limits is based on a monthly calculation of a "rolling 12-month total" and comparison to limits of 9.5/24.5 TPY for individual and aggregate HAPs. The production of the Monthly Hazardous Air Pollutant Report (MHAPER) is a federally enforceable/auditable condition of permit compliance. Use of this method is the basis for the biannual certification of compliance to PDEQ. Monthly emissions compliance data is obtained from sources such as internal chemical purchase and issuance records; vendor-supplied chemical purchase records; fuel purchase records; subcontractor chemical purchase and MSDSs; an internal MSDS database; applicable AP-42 factors; emergency generator hours of operation; and post-control remediation activity emissions. Emissions are calculated in a manner that assumes all HAPs contained in materials purchased and issued for use on site are emitted on the date issued. While this yields an overestimation of actual emissions, it allows for a simpler and more consistent recordkeeping method. The MHAPER reports have proven to be useful for purposes beyond its original design by being able to answer questions impacting other media, identifying materials of interest beyond the list of HAPs, identifying and prioritizing multi-media pollution prevention opportunities, and demonstrating to the public that Raytheon has an on-going commitment to P2 principles beyond the reduction of toxic chemicals below TRI reporting thresholds. The work of the Joint P2 IPT has insured that limited resources available were focused in the most critical areas such as the reduction of Hazardous Air Pollutant sources that have potential to impact compliance with the AFP 44 air permit.

P2 PROGRAMS

Acid Recycling

New technologies have been developed that improve the way metals are removed from acid solutions in surface finishing operations that remove oxides on metallic hardware. During operations, strong acid was used to clean and passivate missile parts. As the metals dissolved into the acid, the acid would become less active and would need to be discarded, and the resulting waste treated. Acid purifying units were installed as part of Air Force Materiel Command, Pollution Prevention Branch (HQ AFMC/CEVV) funded projects to remove metals such as nickel, aluminum or copper from the acid solutions. These units allowed the solution to be reused indefinitely while the surface finishing and printed wire board processes were in operation.

Chlorine Gas Elimination

Chlorine gas was used to regenerate printed wire board etchant solution and to disinfect treated industrial wastewater recycled for process reuse. An AFMC/CEVV funded project that substituted sodium chlorate in place of chlorine gas was implemented for printed wire board (PWB) etchant regeneration. Use of chlorine gas in wastewater recycling was eliminated when the system was replaced with individual process wastewater recycling.

Aqueous Cleaners for the Replacement of TCA and Freons

The introduction of isopropyl alcohol vapor degreasing and aqueous cleaning virtually eliminated the use of 1,1,1-trichloroethane (TCA) and CFC 113 that were formally used in vapor degreasing of metal missile parts. A successful implementation of a recent AFMC/CEVV funded P2 project further reduces the use of the aqueous cleaner with a closed-loop recycling system using a sintered metal microfilter membrane. In addition, a subtle but significant materials substitution was accomplished when it was found the "anti-freeze" properties attributable to the glycol ether constituents of the aqueous cleaner were not needed for the warm ambient temperatures characteristic of Tucson. Therefore, the supplier accommodated the AFP 44 with a glycol ether-free cleaner formulation.

Powder Paint Replacement of Solvent Based Paints

Powder coatings have been accepted as replacement on a number of missile components produced at AFP 44 beginning in the early 1990s. The acceptability of powder paint for use on missile components and substrates continues to expand. This has been a significant factor in the reduction of Volatile Organic Compounds (VOC) and Hazardous Air Pollutants (HAPs).

MDA Elimination by Process Changes

MDA was required as a curing agent in the production of missile parts made from composites. Alternative materials were identified and a new process implemented which utilizes less toxic components in making these composite parts.

High Volume/Low Pressure Wet Paint Delivery Systems

HVLP systems have been installed as a retrofit item for existing wet paint operations where electrostatic discharge is of concern and powder paint cannot be used, and have been included as standard components in new spray booth purchase specifications. This type of system allows for greater transfer efficiencies than standard application guns, thereby reducing the quantity of paint used while maintaining desired production rates.

Automatic, Closed-Loop Paint Gun Cleaning Units

A closed-loop cleaning unit was brought on site at AFP 44, which performed markedly better than previous units in terms of cleaning and in capturing/recycling methyl ethyl ketone (MEK)-containing solvent, thereby reducing usage and emissions. AFMC/CEVV funding provided for the purchase of 5 such units, currently in operation adjacent to paint booths throughout AFP44.

For further information regarding this article, please contact John Stallings, ASC/LPJ at (937) 255-4169 ext. 3014. ♦

JOINT EFFORT REUSES TUCSON EQUIPMENT



State-of-the-art equipment used to treat wastewater in Tucson, Ariz. has found a new home in Marietta, GA. Roughly 10 semi-truck loads of equipment formerly used at Air Force Plant 44 in Tucson were recently shipped by the Aeronautical Systems Center to Air Force Plant 6.

The transfer of equipment signals a positive gain for both plants. Air Force Plant 44 used the equipment in a three-stage filtration process (pressure filter, ultrafiltration and reverse osmosis) to treat industrial wastewater at the treatment plant. However, new wastewater strategies made the reverse osmosis system design equipment unnecessary, according to Mark Orton, AFP 44's industrial wastewater treatment supervisor.

"When the Plant 44 reverse osmosis equipment became unnecessary, it was only four years old and – because of Arizona's climate - was in "like-new" condition," said Orton.

Air Force officials learned at the same time that AFP 6 needed to upgrade an existing industrial wastewater treatment plant with reverse osmosis capability, to provide clean water to several aircraft and repair manufacturing operations.

"This exchange of equipment provided a win-win situation for both plants. They met and exceeded their goals with this transaction," said Capt. Thomas Hamrock, safety and health compliance manager for AFP 6. "The Air Force estimates savings of at least two million dollars upon completion of the project."

Disassembly of equipment from AFP 44 was scheduled to take about five weeks, but instead took only three and one-half weeks. AFP 6 received the equipment in May, with placement on newly poured support pads scheduled for this fall. After assembly, engineers will test the equipment, which is estimated to be operational by June 2001.

"Two government agencies and eight contractors are participating in this gigantic undertaking," according to Mr. Roddy Keish, ASC's integrated product team lead for AFP 6. He added, "the logistics are being managed by Captain Hamrock from a web based system at Wright-Patterson Air Force Base."

The project is being executed jointly by the Air Force, Savannah Corps of Engineers, Lockheed Martin-Marietta, IT Corporation, CH2M Hill, Raytheon, Osmonics, Taylor Controls, ALC Controls and Lockwood Greene.

Lockheed Martin Aeronautics Company currently operates wastewater treatment facilities at AFP 6 under a National Pollutant Discharge Elimination System permit issued by the State of Georgia. Approximately two million gallons of water a day is purchased from the Cobb Marietta Water Authority. Of that quantity, about 1.7 million gallons is treated in the on-site wastewater treatment plant. In addition, Lockheed treats wastewater discharged from the Naval Air Station and Dobbins Air Force Base located adjacent to AFP 6.

Based on the results of a recent Wastewater Zero Discharge study, Lockheed plans to reuse treated effluent (clean water) needed for its aircraft repair and manufacturing functions. To meet water quality requirements, AFP 6 will use the reverse osmosis system equipment to further treat and clean the water until it reaches standards acceptable for industrial use.

The two plants are part of the nine remaining government-owned, contractor-operated facilities managed by ASC's Engineering Directorate, Acquisition Environmental, Safety and Health Division.



Air Force Plant 6 opened in 1942, when Bell Aircraft Corporation began production of the B-29 aircraft during World War II. This production ended in 1946, and the plant was used to store machine equipment and tools until 1951. Since then, Lockheed has operated the facility, which employs about 11,000. The plant consists of Air Force and Lockheed Martin-owned buildings covering about eight million square feet of floor space. AFP 6 manufactures and repairs a number of Air Force aircraft including the C-5, C-130, C-141, F-117 and the new F-22 fighter.

This article was submitted by Don Yates, ASC/ENV Public Affairs.◆

Overview of the Clean Air Act (CAA) (Continued from page 9)

It should be noted that EPA has established P2 as one of EPA's highest priorities and, in doing so, is developing regulations that offer a single emission limit that does not prescribe the control device to be used for compliance. These new requirements instead provide flexibility for cheaper and less energy intensive control technologies (i.e., by allowing the use of clean fuels for reducing NO_x emissions). In fact, for combustion sources, EPA is promulgating output-based standards that express the emission limits in terms of energy produced (i.e., 1.6 lb of NO_x/MWh of energy output) to promote energy efficiency and P2.

This article is found under the Clean Air Act, Hazardous Air Pollutants, DoD Menu, Defense Environmental Information Exchange (DENIX) - www.denix.osd.mil/denix/welcome.html under the DoD Menu of DENIX.◆

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